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ABSTRACT

Creative thinking and critical thinking are often thought of as two distinct, separate processes; however, each is a necessary component of the other. The challenge of critical thinking as creativity is to identify and transcend the nonessential criteria associated with the domain in which the critical thinking is exercised while not abandoning essential criteria. Analogical reasoning and metaphorical thinking are important to creative thinking. In the conception of critical thinking as creativity, emphasis is placed on discovering new ideas and the connections among them. Creative work often involves detachment, reflection, ambiguity, and risk. Suggestions for fostering creativity as critical thinking in school settings include having students collaborate on group projects, incorporating metaphors into the educational process, and using students' curiosity as a starting point for projects and tasks. Teachers can model the creative process themselves in addition to encouraging it in students. Professional development activities may be useful in helping teachers to develop creative thinking in themselves and insight into the creative process. (Contains 16 references.) (IAH)

MONTCLAIR STATE

Critical Thinking as Creativity

Wendy Oxman-Michelli

Institute for Critical Thinking
Resource Publication
Series 4 No. 5

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Montclair State
Institute for Critical Thinking

Resource Publication Series
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The Institute for Critical Thinking at Montclair State is designed to support and enrich faculty development efforts toward critical thinking as an educational goal. Working closely with faculty from Montclair State and colleagues from campuses around the world, its primary purpose is to serve as a catalyst in the development of educational excellence across the curriculum at Montclair State. A collaborative, multi-disciplinary approach is in process, with attention to the study of both the theoretical aspects of critical thinking across the disciplines and their implications for teaching and learning at the college level. In addition, the Institute reaches out to colleges and schools, helping them to incorporate critical thinking into their curricular plans.

As part of this effort, the Institute for Critical Thinking publishes a newsletter, *Inquiry: Critical Thinking Across the Disciplines* on a monthly basis during the academic year. The newsletter includes information about the activities of the Institute as well as short papers on topics relevant to critical thinking. The Institute also publishes an ongoing series of Resource Publications. These documents make available, to interested faculty and others at Montclair and elsewhere, working papers related to critical thinking as an educational goal, offering extensive discussions of the kinds of issues that are presented in summary form in the newsletter. Resource publications are regarded as works-in-progress: articles written as tentative arguments inviting response from others, articles awaiting the long publication delay in journals, etc.

Proceedings of our annual conferences are also published by the Institute. To date the following proceedings have been published and are available at cost:

Critical Thinking: Language and Inquiry Across the Disciplines, Conference 1988 Proceedings
Critical Thinking: Focus on Social and Cultural Inquiry, Conference 1989 Proceedings.

In addition, the proceedings of more recent conferences will soon be available. In preparation are:

Critical Thinking: Focus on Science and Technology, Conference 1990 Proceedings
Critical Thinking: Implications for Teaching and Teachers, Conference 1991 Proceedings

In this fourth series of resource publications, we have again included working papers by members and guests of our Institute Fellows' "Round Table." Many of these working papers have been presented for discussion at one or more of the Fellows' seminar meetings, and have influenced our thinking about the nature of critical thinking as an educational goal. We have also included papers dealing with practical applications of the Institute's work and of related projects in other settings.

The Institute welcomes suggestions for our Resource Publication series, as well as for our other publications and activities. Correspondence may be addressed to the Editors:

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CRITICAL THINKING AS CREATIVITY

Wendy Oxman-Michelli

In this approach to critical thinking, creative thinking is conceptualized as a necessary component of the critical thinking process; critical thinking as a necessary component of creativity. In critical thinking as creativity, the "mindful response to diversity, or discrepancy" focuses on your response to the diversity you find among your own ideas. Critical thinking as creativity involves the continuous interplay among the generation, assessment, selection, and assembly of ideas. The process of thinking creatively starts with the assembly of ideas—musical ideas, theatrical ideas, visual ideas, scientific ideas, poetic ideas, pedagogical ideas. Actually, creative thinking starts with the sloppy, messy, playing around with many different ideas — figuratively speaking, and, depending on the medium, a literally, sloppy, messy, playing around with materials as well. These ideas are like friends that children play with after school. The ideas that you start to play with are ideas that you already have; others will come along and join in the fun, hopefully just when you want them. Choices, however, will have to be made among these ideas, hard as that may seem; only one person can be the pitcher, or play the mommy. Some of the ideas won't cooperate; you may have to banish them. You may regretfully have to send some of them home, perhaps to be invited back to play another time. Some may disappear on their own accord; perhaps their mothers called them home for dinner. I am describing the ideas that go into a creative effort as if they had minds of their own—playful, active minds. In a sense, that is indeed what I mean. Creativity, as critical thinking, then, is your own mindful response to your own ideas.

Critical thinking as creativity involves dialogue between you and your creative work. You have put these forces into action, and it's your job to see it through. However, you're not alone. You've got all those ideas with you. These ideas, like your childhood friends, have personalities. They can be challenging, helpful, moody, recalcitrant, obstinate — all the qualities that you remember about your childhood friends. Like friends, too, the more you have, and the wider the contexts from which you draw them, the richer the dialogue — the richer the play among you.

Note: *This resource publication is a preliminary version of a chapter to be published in* The Many Faces of Critical Thinking, *a compilation of a variety of approaches to conceptualizing critical thinking as an educational goal. A list of chapter headings can be found in the Appendix. Comments and suggestions on this working paper will be especially welcome.*

Critical thinking and creative thinking

Critical and creative thinking, according to some accounts, are considered two separate processes. Contrasting one with the other, creative thinking is regarded as thinking that is artistic and free, imaginative and spontaneous, original and intuitive, whereas critical thinking is seen as logical, analytic, and judgmental. When you think creatively, you produce something novel; an aesthetic object, a new approach to an ethical issue, a mousetrap, a reasoned argument, an experiment. When you think critically, you evaluate the worth of the creative product according to explicit principles, such as aesthetic standards, rational criteria, and other norms and conventions of the domain or discipline in which you're working.

While it is convenient to associate the generation and organization of ideas with creativity, and the assessment and selection of ideas with critical thinking, this is a distinction that can be made only for the purpose of analysis. In this approach, critical thinking and creativity are considered to be two sides of the same coin—pennies, perhaps. Put all the pennies face up to study the creative facet of the process—the part that is involved in generating and organizing ideas; all pennies face down to study the critical facet of the process—the part that involves assessment and selection. A thousand dollars' worth of pennies might be taken to represent all the decisions that are made during the process, although a metaphor that assigns a monetary value to the results of a creative effort is in other respects a very poor choice. In practice, however, there can be no critical thinking without creativity, and no creativity without critical thinking; both are essential. Critical thinking and creativity can more effectively be distinguished from the routine, the conventional, the ordinary, the habitual, the ways of thinking about and doing things that are mindless—that require no personal effort—than they can from each other.

Critical thinking as creativity and the use of criteria

Critical thinking as creativity demands, like other conceptions of critical thinking, the satisfaction of essential criteria of the domain — the discipline, genre, medium, research paradigm in which it is exercised. Typically, it involves a challenge to identify and transcend non-essential conventional standards implicit in traditional frameworks and representations within that domain. Breaking rules that are not *necessary* frees the critical thinker to seek ideas from elsewhere. How do you know, however, which rules are essential and which are not? That's the hard part. As a creative thinker, you have the very difficult task of distinguishing among a variety of potentially applicable criteria, of selecting which criteria to satisfy and which to ignore; that is, which rules to observe and which to break. These criteria do not stay in the foreground of your thinking, however. They reside in a sort of rule book, to be consulted when necessary. Most often, you've got a general sense of what they are. The more

experience you have in a domain, the less conscious you are of the rules, but the more they actually guide your work. When you engage in a creative task, you make choices among the possibilities you have found, while searching for and generating more possibilities, etc., until you determine that the work is finished, or "realized," and choose to stop. These choices are judgments; assessments, evaluations. They are based on the implicit or explicit rules, or criteria, that you have *chosen* to observe.

The challenges involved in creativity, as in other applications of critical thinking to self-selected activities, also involves setting goals, determining and executing strategies, and evaluating progress (Newell and Simon, 1972). Typically, many ideas — some good, some bad — are tried out before something is judged to have potential and is chosen, and the process begins again. There is a great deal of current interest among historians of art, music, and literature in the sketchbooks and notebooks kept by creative individuals. By studying the creative process in this way, these historians are acknowledging that there may well be more hard work involved in creativity than "divine inspiration." Creativity in one's scholarly or scientific work, or in one's teaching is the same thing — mindful responsiveness to diverse ideas. Teaching for critical thinking — teaching for creativity, is helping students respond mindfully to diversity.

Steven Sondheim's *Sunday in the Park with George* (1986) is about creativity. Sondheim's lyrics, written by a playwright about a visual artist, contain many poignant sequences that can help us understand the creative process. These lyrics include:

Bit by bit, putting it together...
Piece by piece
Only way to make a work of art
Every moment makes a contribution
Every little detail plays a part
Having just the vision's no solution
Everything depends on execution
Putting it together...

The art of making art
Is putting it together
Bit by bit...

Critical thinking as reasoning emphasizes the sequential arrangement of claims and grounds in a linear logical sequence within a rational argument—the mindful response to diverse claims and counterclaims. Critical thinking as problem solving emphasizes the sequential arrangement of a series of strategies for action that maximizes progress toward a well-defined goal — the mindful response to alternative linear action sequences.

In critical thinking as creativity, the emphasis shifts to the process of defining and redefining the task itself, including its goals, as unexpected discoveries and sensitive choices are made in a recursive, rather than linear process. In a task that is primarily a creative one, the process of defining and redefining the task itself and its goals maintains the spotlight throughout. The ultimate goal of creative thinking is not structured or perceived at the outset, but "shaped along the way" (Perkins, 1990, p. 40), who refers to this on-going exploration as problem *finding* rather than problem *solving*. At any point, a re-examination of the whole effort, may take place, and the problem redefined, or newly "found." Problems can be redefined while engaged in any type of task. In creative work, however, when the problem is finally "found," the creative work itself, or the creative aspect of a larger task, has been completed.

Creativity and the creative task

What are you doing when you think creatively? You're working in the "hypothetical mode;" thinking in the conditional tense: What would happen if...? Again, from Sondheim's Sunday in the Park:

George, sketching the dog:

If the head was smaller
If the tail were longer
If he faced the water
If the paws were hidden
If the neck were darker
If the back was curved
More like the parasol...

Creative thinking is often metaphoric thinking. It involves thinking about one thing in terms of another— drawing from different experiences and areas of knowledge, making connections among ideas drawn from different domains. Analogical reasoning—thinking in terms of analogies or metaphors — is essential to creativity. Metaphoric thinking, too, is involved in mindful learning to a much greater extent than is commonly recognized.

Jerome Bruner (1962) notes, using much metaphoric language:

> "Whoever reflects recognizes that there are empty and lonely spaces between one's experiences. Perhaps these gaps are the products of reflection or at least its fruits" *(p. 60).*

Creative thinking as the fruit—as the product of reflection? We might have thought it to be the seed of reflection. Indeed, it is undoubtedly both, with mindful reflection stimulating creativity, which stimulates further reflection. The goal of critical thinking as creativity may be, figuratively, to fill, or to bridge this gap. The metaphor of "bridging a gap" suggests risk-taking, another aspect of creative thinking; in making an inference there is

always the risk of not bridging the gap sucessfully.

These "empty and lonely spaces" provide opportunities for creativity. Not everyone choses to try to fill them—not everyone choses to identify them in the first place. Problem *finding?* Why look for trouble? Creativity is, indeed, lonely — you really are alone with your ideas, and no one else is likely to care what you're doing (or they might care for the wrong reasons). Creativity is also "egotistical" in the conventional sense of the word—self-serving, in terms of the traditions and values of our materialistic society. Creative effort uses resources—time and materials — that might otherwise be used for more ordinary purposes. It is also very hard work, with no assurance of success...not even in terms of one's own self-satisfaction. You may very well fail; you might put in a lot of time and effort and money for materials, and fail. You may, of course, succeed in meeting your own standards — satisfying your own criteria for creative success, but not receive any social recognition. The stakes, in terms of social expectations, are too high to serve as motives for creativity.

From *Sunday in the Park:*

> *Work is what you do for others, Liebchen;*
> *Art is what you do for yourself.*

Dreaming of recognition for your creative work is like dreaming of playing professional basketball. If you don't make the NBA, you'll have to play basketball for yourself — for the love of the game. It's even harder to gain recognition for creativity than for athletics, because creative work involves work *contrary* to conventional expectations, and therefore depends on the establishment of new criteria to judge your work. The criteria that determine success in terms of fame and fortune are very different from the criteria for creativity.

Sunday in the Park with George is not only about creativity, but about the tensions between commitment to one's creative vision, and the need for community recognition and support. The first act is mainly about George Seurat's artistic commitment; the second is about the struggle of his grandson to balance his need to grow and change creatively; that is, to explore new possibilities, with the need for money for materials.

> *Art isn't easy*
> *Every minor detail*
> *Is a major decision*
> *Have to keep things in scale*
> *Have to hold to your vision—*
>
> *Every time I start to feel defensive*

I remember lasers are expensive
What's a little cocktail conversation
If its going to get you your foundation
Leading to a prominent commission
And an exhibition in addition—

...If you want your work to reach fruition
What you need's a link with your tradition
And of course a prominent commission
Plus a little formal recognition,
So that you can go on exhibi—
(getting flustered)
So that your work can go on exhibition.

Link by link
Making the connections
Drink by drink...

Critical thinking as creativity and detachment

In this conception of critical thinking as creativity, emphasis is placed on the creative drive toward discovery; the discovery of new ideas and connections among them. Discovery is involved in identifying which rules can be broken; discovery is involved, too, in the analogical connections that are made with ideas that emerge through your work. There is continual tension, throughout, between the need for the structure that is provided within the traditions of your discipline or domain, and the need for detachment and discontinuity—the need to expose yourself to ideas from elsewhere. Creative work in a discipline involves detachment from the community represented by that discipline and discontinuity from its conventions. In research on cognitive development conducted by Karen Kitchener and Patricia King (King, 1990), based on Perry's (1981) model of intellectual development during the college years, immersion in a tradition represented by an academic or artistic discipline involves internalizing the norms of that discipline.

Design/ composition/tension/balance/light/ and harmony

In these lines from Sondheim's work, George Seurat seems to be rehearsing, to himself, the essential criteria — the normative traditions — of his discipline.

Immersion in an academic disciplinary tradition provides conventional modes of inquiry and communication, and conventional standards for evaluation (e.g. criteria for statistical significance) within that discipline. In King and Kitchener's work, achieving a notion of "reflective judgment" that coincides with the perspectives — the essential normative judgments of a particular specialized disciplinary community is called achieving "Stage 5."

Stage 6 involves the recognition that multiple, cross-disciplinary perspectives must be considered, while Stage 7 involves the kind of personal, reflective search for understanding and synthesis across contexts that represents creative thought. Creative work can be done within a specialized discipline, of course, for the disciplines themselves are dynamic entities, growing and changing in response to creative challenges. Creative work in the academic disciplines or in the artistic domains, requires risk and courage, individuality and commitment, disengagement and exploration beyond the current status of the discipline or domain. And that goes for the area of inquiry called critical thinking, and for the domain of education, as well.

Although examples from creativity in the arts are usually cited as instances of creative projects, creativity in the sciences, the professions, in all domains of human endeavor require the same kinds of work. Creative thinking—the creative generating and creative ordering or organizing of ideas— is also involved in tasks that are more heavily analytical and rational. There are creative aspects of all complex tasks, including teaching.

Since the goal of a particular creative endeavor cannot be clarified in advance, and conventional criteria may not "fit," it may also be impossible to specify in advance the particular criteria by which its products will be assessed. How do we know when a creative product is creative? What shall we "count" as creative? That is, what are the criteria by which we shall judge whether or not something is creative? To be considered creative, must the outcome of creative activity—a scientific discovery, a painting, a mathematical formula—represent the first time an insight is made by humankind, or does a re-invention of a discovery previously made by others, but new to the individual, count? Of course, this decision depends on context; the criteria to be applied depend upon the domain in which the judgment is being made. Is the decision to be made subject to criteria that are scholarly? commercial? pedagogical? Since we are most interested in the educational applications of critical thinking, we will take the broadest view; the one that sees creativity in the productive efforts of an individual engaged in a creative task, generating what is for that person a creative product, even if the product demonstrates a "reinvention of the wheel."

Creativity and courage

Creativity is hard work; for the artist, the scholar, the teacher. A passionate commitment to your work usually involves some periods of intense, sometimes obsessive preoccupation, balanced by periods of incubation.

The task gets difficult, burdensome, and lonely. How long do you persist? How long do you continue before abandoning your project? *"How long can you tread water?,"* as Bill Cosby, in his famous comic routine, had God ask Noah when he wanted to abandon building the ark. Once you've started a creative project, it often feels necessary — it's become a part of

you, despite its difficulties. It's a driving force, an obsession; you do it because you can't stop — you know that if you stop, you won't be able to tread water very long. People differ, of course, in terms of their desire and willingness not only to accept, but to maintain the challenge of creativity. Wertime (1979) calls the period of time during which one persists the "courage span," by analogy with the concept of "attention span," suggesting that, as teachers, we help students " widen their courage spans" in problem solving, which he describes as involving creative effort.

Wertime also discusses the "act of the will" by which we agree to commit ourselves to such a project. Commitments, he says, are the "stuff of which our self-esteem is made." All creative problems are, thus, personal problems. All creative tasks, are, thus, personal tasks. Undertaking a creative task involves both fear—of loss of self esteem—and hope: perceiving the task as an opportunity implies that one expects to succeed. Giving up the task is to give up part of oneself. This kind of commitment, along with the need for courage, is also involved in creative group projects as well as in group projects that focus primarily on reasoning, as in a "community of inquiry" approach.

Creativity, ambiguity and risk

Jerome Bruner (1962), in his essay entitled *The conditions of creativity*, discusses some of the paradoxes that characterize a creative task. These paradoxes are contradictions that contribute to the sense of uncertainty and risk typical of creative tasks, but that are necessary for creative work. To Bruner, as well as to other writers about creativity, a creative task requires a wholehearted, passionate commitment *both* to the project one has undertaken and to oneself; to the exploration of one's own individuality and intuitive self-expression.

Again, from Sondheim's work:

There's a part of you always standing by.
Mapping out the sky,
Finishing a hat
Starting on a hat
Finishing a hat

(showing sketch to dog:) Look, I made a hat
Where there never was a hat...

Awareness of, and courageous self-confidence in, your own vision is necessary. Your intuitive perceptions must also be balanced with your conscious intentions. Having initial intentions is not the same as having a specific goal. You must have the willingness to surrender yourself to the project, to let it find its own way. The creative, self-assigned task takes on a

life of its own; it invites the creator into a dialogue with the new reality in the making. This aspect of creativity, of course, is hard to document, but there is a good deal of evidence in the form of anecdotal reports by creators themselves that the effect does occur. Some theorists, including Bruner (1962), indicate that it is an essential component of the process. He quotes an unnamed novelist and critic who said 'if it doesn't take over and you are foolish enough to go on, what you end up with is contrived and alien' (p. 26).

Creativity and "effective surprise"

Critical thinking as creativity involves the generation of "effective surprise" (Bruner, 1962). "Effective surprise," however, is neither the act of creativity itself nor the creative product, but a *response* to it, on your part, as creator, and perhaps, on the part of others. This response, however, is part of the multi-stage creative project itself. Krieger (1976) notes that the successful poet feels forced "to press beyond words that satisfy minimal requirements toward those which established unlooked for maximal possibilities that they, to his and our surprise, satisfy" (p. 28).

Thus, through the complex generative and selection processes of creativity, a product is generated: a painting, a play, a poem, an essay, a song, an advertisement. Having taken on "a life of its own," the creative product affects others, including its own creator. When new meaning is appropriately communicated, the response is that of "effective surprise." When new ideas are generated without being effectively communicated, they will seem bizarre. Sometimes, an individual product can only be understood in the context of a body of related works, each product serving the communicative function of explaining the others. When ideas are effectively communicated but not new, they will not be judged as creative.

Creativity and community

Most of us hold images of a creative person alone in his cold attic garret, spinning imaginative fantasies out of the yarn of his or her lonely reveries. I have, in fact, defined the creative process as a lonely one. However, our creative ideas are drawn from the experiences we have had in the communities in which we live and have lived. Directly and indirectly, the families and neighbors we knew as children, the schools we attended, our teachers and classmates, our friends, professional colleagues, loved ones, the activities we pursue, even the global village as we experience it through televison, all provide conceptual form and content for the creative process, as well as influencing the value we place on creativity itself. We think creatively as members of multiple communities, past and present; our ideas are shaped within and collide across rich layers of images and impressions drawn from multiple, continuously changing communal sources outside ourselves. Distilled, reconstituted, transformed, and articulated through the creative process, these ideas shape a creative product of the

products we create. Now with "lives of their own," they reflect the ideas of the communities within which they were nurtured.

Will the product of the creative process create "effective surprise" in others? Sometimes—if the communities within which the ideas were shaped still exist or if we have found new communal sources to serve as wellspings for— and as audience for— new ideas. If we discover new juxtapositions and new connections among ideas from diverse sources, and if the new combinations "work" in the sense that both form and content communicate these new connections to others, the ideas may find an audience "out there." Whoever created that TV rabbit, that keeps going and going, intruding on other commercials with its advertisement, certainly generated effective surprise!

These new connections need not—in our complex world—probably cannot—communicate instantly. For example, the title song of Paul Simon's *Graceland* album combines poetic and musical imagery and form from multiple sources, and has found a wide audience for whom the sounds create "effective surprise." I can listen to this song many times, and be surprised by something I hadn't noticed before. Woody Allen's films, similarly, feature unusual juxtapositions of ideas; they, too, can surprise you more than once with additional or deeper meanings that went unrecognized in previous viewings. The paintings of David Salle, which feature boldly rendered images harshly superimposed on pale ghostly figurative backgrounds in a seemingly arbitrary fashion, also reveal multiple meanings the longer one views the painting. The juxtaposition of unrelated imagery seen in these works is a convention of the art of our post-modern era; the extent to which the artist helps this unrelated imagery work together is what creates meaningful surprise.

Creativity and the "critical spirit"

The "critical spirit" underlying critical thinking is closely related to a conception of critical thinking as creativity. The "critical spirit" involves all the personality attributes, motives, values, and interests that predispose a person to think critically. In a creative task, ambiguity and uncertainty are especially pronounced, and tolerance of this ambiguity and uncertainty are especially important. Thus, the intrinsic motives to create (Amibile, 1983), stimulated by relevant character traits, take on primary importance. Among these personality traits are:

***independence of mind**, in the sense of intellectual autonomy, self-understanding, self-confidence, and courage.*

***openmindedness**, in the sense of alert curiosity, attentiveness, the spontaneous outreaching for alternative perspectives, intellectual flexibility and the willingness to suspend judgment;*

***wholeheartedness**; that is, enthusiasm and perseverence in pursuit of an intellectual goal;*

These traits—and the values and dispositions through which they influence one's choices and one's actions, help to guide the creative process.

Creativity and connectedness

Creativity, as we have noted, is not all self-expression. Although one must disengage from "habitual and literal ways of looking, hearing, and understanding in order to resolve the ambiguity that is a feature of works of art" (Bruner, 1962, p. 67), one must also conform to the essential constraints of a particular conventional form. In addition to seeking meaningfulness through the structure of essential conventions, one seeks new understandings at the broadest, most fundamental level possible. These levels contain the greatest potential for the discovery of new insights, for fruitful elaboration, and for the widest possible applicability, whether in the arts or sciences.

Critical thinking as creativity, then, is an effort toward connectedness; toward discovering new, meaningful connections among diverse perspectives. There is an attempt to provide a new, higher order synthesis of dissimilar experiences, typically, through the use of new metaphors, images, transformations, or symbols that suggest a more abstract, deeper level of meaning than was previously available. It is in this sense that "creative products have the power of reordering experience and thought in their image" (Bruner, 1962). An art student who learns about Cezanne's effort to present elements of form in terms of flat planes parallel to the surface of the canvas, may come to understand, simultaneously, why the distortions of common perceptual reality were necessary to Cezanne's vision, and how cubism developed as an extension of Cezanne's work, etc. That student, walking away from such a lesson, may suddenly see an ordinary, familiar landscape, or cityscape, in terms of the flat planes that Cezanne painted. Cezanne's abstract painting, then, for that student, had the power of reordering experience and thought in its own image.

Wertime (1979) calls this process of creative discovery "a leap of imagination and intellect;" Polanyi (1962) calls it the "plunge by which we gain a foothold at another shore of reality" (p. 123). It involves the breaking free of the common modes of representing experience and the construction of new and unexpected elaborations, combinations or modifications but within a particular conventional mode, imposing its known formalities on reluctant realities. Perkins (1988) and Johnson-Laird (1988) both note that creativity calls not only for results that are original, but that are appropriate; results that satisfy the criteria of a domain. These criteria are often tacit rather than explicit principles of the domain that are common to all working within it. In addition, there are criteria that serve as constraints imposed by the style of an individual.

Only rarely are the results of a creative endeavor recognized as the construction of an entirely new mode of expression (e.g. literary genre, "school of painting," or "research paradigm") these unusual occurrences are regarded, usually in hindsight, as historical landmarks establishing entirely new domains of creative endeavor.

A creative product, whether a work of art or of science, reorganizes experience and thought "in its own image" for the individual engaged in the process of discovery and invention, in the sense that that person incorporates that new way of thinking into his/her expectations of reality, and is no longer able to think in the old ways. Sometimes, this alteration occurs suddenly, taking the form of insight, ("aha!"); sometimes only through slow changes. Some creative products have the effect of reorganizing ways of thinking for others as well as for its creator, and when they do, there is the potential for fame and fortune. Major or minor, personal or communal, this work involves the individual achievement of critical thinking as creativity. Whether a creative product becomes recognized for its contribution to humanity, or represents a discovery that is new only to the individual, the creative process is the same, and the product is the result of critical thinking as creativity. The criteria that determine whether a creative product represents a social contribution or historic breakthrough are different from those criteria that determine whether a product is a creative one.

Paralleling creative processes in the arts are creative processes in the sciences. Kuhn (1970) makes a distinction between radical and normal science, a distinction with applications well beyond the physical sciences that shaped his thinking. Normal scientific practice is conducted within a particular "paradigm," a broad, theoretical approach to a domain of inquiry. Within a paradigm is a body of accepted knowledge, definitions and assumptions, and modes of inquiry. A scientist working within that domain raises questions and conducts research consistent with the conventions and criteria of that domain. Some of this work involves "routine" or "skilled performance" tasks; some questions need to be answered that require no more than the application of known procedures. There are, however, within each domain, "empty spaces" that provide opportunities for creative challenges. To the extent that questions are raised or research methods are followed that are innovative and unexpected, that overcome —that go beyond—routine aspects of the work, the work is creative. Even when most of the work is otherwise conventional; to the extent that it is mindful rather than routine, at least part of it is creative work.

Radical science, on the other hand, always involves creativity, as it represents a break with the conventions of the domain, creating new possibilities out of the old, revisiting, redefining, and reorganizing what is known, raising new questions or old questions in new ways, creating new paradigms— new ways of thinking about the domain itself, its conventions and assumptions. Sometimes, if particularly fruitful, this kind of science

results in the establishment of a new domain of inquiry. Both kinds of scientific endeavor involve critical thinking as creativity.

The established academic and professional disciplines, in the arts, humanities, social, and physical sciences and mathematics, contain within them domains of inquiry that are dynamic in nature. These disciplines serve as forums, or interpretive communities within which different ideas and ways of knowing "compete for survival," on both small and large issues. General criteria of rationality, equity, and originality, profundity, elegance or parsimony, rather than power politics, it is assumed, serve to determine the outcome. The work of criticism in art, music, literature and theater, the peer review process involved in grant funding and publication in the sciences, social sciences, and philosophy, the work of evaluation of the social and/or economic outcomes of variations in professional work all keep active members of the disciplines involved in critical thinking about the fundamental knowledge, assumptions, modes of inquiry, and questions in that discipline. New disciplines form when these processes break down. The disciplines themselves, as structured, but changing fields of inquiry, are dynamic examples of creative projects themselves.

Critical thinking as creativity and inquiry: The role of the critic

The work of the critic, too, is creative work. The critic's work involves the development of a coherent system of critical analysis within which the elements of individual works of art can be related, one to another, within which the sources of the works' inspiration can be sorted out from the product of that inspiration and within which diverse works of art can be characterized, classified, and compared. A critical theory, which encompasses an integrative system of criteria, serves as a pair of spectacles, providing clarity and coherence of focus; highlighting features of the work of art that address—or fail to address—the criteria included in the system and neglecting those that do not. Its formal perspective mediates—it intrudes on—a direct, personal apprehension of the work of art. But critical theory cannot be avoided (Krieger, 1976). We are all both creators and critics; we approach the creative products from some theoretical — if naive— perspective—or several, to the extent that the elements of our tacit theory are inconsistent with each other. Criticism — the work of the critic —like that of the creator, illustrates well the dialectical interrelationship of creativity and critical thought. The development of consistent, reflective, systems of theoretical criticism must always be in the process of change. Such theories must provide enough structure for analysis to take place and at the same time keep themselves open to new insights that challenge the analytic structures itself.

Critical thinking as creativity and academic tasks

Can, and should, critical thinking as creativity be encouraged in school, and if so, how? Has not the recent emphasis on thinking taken care of this? Have not all the recommendations growing out of the thinking skills movement, and featured in lay publications as well as professional journals, taken care of the infusion, immersion, infiltration, of critical thinking, broadly conceived, into every aspect of the educational process. Not so, apparently. In the April 7, 1991 edition of "Education Life," a semi-annual special section of the *New York Times*, we find an article recommending that the "noisy" classroom be encouraged. In a noisy classroom, children are encouraged to talk with each other and are not scolded into sitting quietly, waiting for routine instructions from the teacher. It would seem that there is a limitless tendency to characterize classrooms as places in which the teacher talks and the students listen.

So an attempt to describe how critical thinking as creativity can be encouraged in school must start from the beginning, rather than from some intermediate step which assumes that critical thinking has become a reality in the classroom. Students' intrinsic desire to contribute to a group effort—what Bruner (1966) calls "reciprocity" can be used to good effect to foster creativity as critical thinking. A first step, then, would be to encourage communicative dialogue among students; to encourage students to express their ideas in their own voices, and to respond thoughtfully to the ideas of others. Collaboration with others in a creative group task might be a good place to start. Collaboration and communication can be fostered through the design of group projects; involving students in the design itself adds an element of self-assignment to the process. Work on a student newspaper, magazine, mural, or videotaped "TV program" are examples of group activities that can be used to foster and encourage critical thinking as creativity.

At each step of a group project, students can be encouraged to spend more time exploring possibilities before settling on easy choices to achieve closure. They can be encouraged to maintain a fluid, flexible view of their work, and to change directions when new ideas emerge. Brainstorming, of course, is useful; brainstorming to focus on the generation of possibilities. In brainstorming, the sub-process of idea generation is artificially separated from that of assessment. Criticism is banned, closure is deferred, fluent production of novel ideas, elaboration and metaphoric exploration are encouraged.

Surprisingly, there is little attention, in schools, paid to metaphor, which is such an essential element of creativity—and of comprehension, too (Ortony, 1979). I used one metaphor when I described ideas as childhood "friends," another in describing critical and creative thinking as "two sides of the same coin;" and another in referring to "bridging gaps" between ideas. Metaphors emerge in all sorts of straightforward textbooks and other

classroom materials—even on the SAT exam! They are usually regarded as irrelevant, or misleading, but they can be used very effectively in the educational process itself (Barell & Oxman-Michelli, 1984).

Another way to encourage critical thinking as creativity is by drawing on students' inherent curiosity. Developing projects and tasks that permit students to study what piques their own individual curiosity will maintain their interest through what might otherwise seem like drudgery. Sternberg (1991) relates an incident in which he was invited to speak to a group of high school students about psychology; rather than lecturing about the results of psychological inquiry, he proceeded by asking them what aspects of human behavior they found puzzling. Working from their questions, he helped them design individual—and creative— investigations to find out about the behavior that interested them.

Creative effort, as I have noted, is hard work. How can students be encouraged to maintain creative work beyond the initial, relatively easy stages? How can students extend their "courage span;" how can they maintain positive self-regard even if a particular piece of work must be abandoned? Clearly, we want our students to take risks, to explore novel ideas, to learn to withstand the tendency to give up when the going gets boring, or lonely, or rough. One thing that will help is the encouragement of the teacher, of course; another is the provision of plentiful time and materials. It is not well known, I believe, that in many schools, even paper and pencils are in short supply. Money seems to be available for expensive, consumable commercial books and workbooks, but not for the much less expensive blank pieces of paper and other materials that are necessary in large quantities for creative work of many kinds. And both students and teachers often seem to prefer less hazardous approaches to teaching and learning, particularly in situations in which the fear of failure with regard to externally imposed criteria through examination and teacher evaluation systems are very real.

Critical Thinking as creativity and the role of the teacher

In addition to providing encouragement for creativity, teachers can model the creative process itself. Too often, teachers say that they themselves are "not creative." Often, they mean that they do not choose to pursue artistically creative activities; sometimes they mean that they prefer, in most circumstances, to act routinely rather than innovatively. Creativity—of all kinds— can be fostered in adults as well as in children; professional development workshops might be helpful in encouraging personal creativity in teachers. Some teachers might recognize that many of the personal activities they do engage in, and many professional activities as well, involve creativity. They may notice that they have not permitted themselves to pursue creative interests that they do have, or that they have not developed interest in creative pursuits, but admire it in others. To be sure, they might still choose not to pursue creative activities on their own, but they will gain insight into the range of such endeavors, the creative

process itself, and into the effects of teacher behaviors on students' creative efforts. For instance, teachers can learn to encourage and reward mindful searches for ideas-- reflection, risk taking, exploration and experimentation, and metaphoric thinking. They can help students withstand discouragement, and provide support for each other. They cannot just be told to do these things; the effects must be experienced. Chances are that teachers can learn to encourage creativity, and they will learn to enjoy the creative — if noisier — classroom, as students learn to set—and pursue— their own creative agendas.

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